

Claims

1. An inhaler comprising a housing to receive a plurality of blisters each having a puncturable lid and containing a dose of medicament for inhalation by a user, a mouthpiece through which a dose of medicament is inhaled by a user and, an actuator operable to sequentially move each blister into alignment with a blister piercing member, said actuator also being operable to cause the blister piercing member to puncture the lid of an aligned blister such that, when a user inhales through the mouthpiece, an airflow through the blister is generated to entrain the dose contained therein and carry it out of the blister and via the mouthpiece into the user's airway.
2. An inhaler according to claim 1, wherein the actuator is pivotally mounted to the housing.
3. An inhaler according to claim 1 or claim 2, wherein the actuator comprises an arm pivotally mounted to the housing at one end.
4. An inhaler according to claim 3, wherein the blister piercing member depends from one side of said arm positioned so as to extend through an aperture in the housing in a closed position, in which the arm lies substantially against the housing, to pierce the lid of a blister aligned with the blister piercing member.
5. An inhaler according to claim 3 or 4, wherein the piercing member comprises at least two discrete piercing heads operable to pierce a corresponding number of holes in a blister aligned with the blister piercing member.
6. An inhaler according to claim 5, wherein each piercing head comprises a primary cutting element and a pair of secondary cutting elements extending laterally across each end of the primary cutting element.
7. An inhaler according to claim 6, wherein the primary cutting element and the secondary cutting elements each have a pointed tip, the tip of the primary cutting

element extending beyond the tips of each of the secondary cutting elements.

8. An inhaler according to any of claims 5 to 7, wherein an opening is formed in the arm in the vicinity of each piercing head, at least one of said openings
5 forming an airflow inlet into a blister and, at least one other of said openings forming an airflow outlet from a blister.

9. An inhaler according to claim 8, wherein the mouthpiece is on the arm and extends in a direction opposite to the direction in which the piercing heads extend,
10 the openings in the arm being in communication with the inside of the mouthpiece.

10. An inhaler according to claim 8 or claim 9, wherein the mouthpiece includes a primary chamber having an outside air inlet in communication, via the primary chamber, with the or each airflow inlet opening in the arm and, a secondary
15 chamber in communication with the or each airflow outlet opening in said arm such that, when a user inhales through the mouthpiece, air is drawn through the or each airflow inlet opening into the blister via the outside air inlet and the primary chamber to entrain the dose in the airflow, said entrained dose passing through the or each airflow outlet openings into the secondary chamber of the mouthpiece from
20 where it is carried into the user's airway.

11. An inhaler according to claim 10, wherein a partitioning wall separates the primary and secondary chambers within the mouthpiece.

25 12. An inhaler according to claim 11, wherein at least one air bypass aperture extends through the partitioning wall to communicate the primary chamber with the secondary chamber.

13. An inhaler according to claim 12, wherein the or each bypass aperture is
30 configured such that the airflow from the primary chamber into the secondary chamber through the or each bypass aperture and the airflow from the or each airflow outlet openings meet substantially at right angles to each other.

14. An inhaler according to any preceding claim, comprising an indexing mechanism including an indexing member that moves a blister into alignment with the blister piercing member.

5 15. An inhaler according to claim 14, wherein the indexing member comprises an indexing wheel that rotates to move a blister into alignment with the blister piercing member.

10 16. An inhaler according to claim 15, wherein the indexing wheel is configured to rotate to move a blister into alignment with the blister piercing member in response to rotation of the actuator in one direction, movement of the actuator in the opposite direction being operable to puncture the lid of a blister aligned with the blister piercing member.

15 17. An inhaler according to claim 15, wherein the indexing wheel is configured to rotate to move a blister into alignment with the blister piercing member in response to rotation of the actuator with respect to the housing in one direction, movement of the actuator in the same direction also being operable to puncture the lid of a blister aligned with the blister piercing member.

20 18. An inhaler according to claim 16 or claim 17, including a cap attached to the housing pivotable between a closed position in which it covers the mouthpiece and an open position in which the mouthpiece is revealed to enable a user to inhale through the mouthpiece.

25 19. An inhaler according to claim 18, wherein the indexing wheel rotates to move a blister into alignment with the blister piercing member in response to rotation of the cap with respect to the housing from the open to the closed position.

30 20. An inhaler according to claim 19, wherein the cap and the actuator include co-operating means to couple the actuator to the cap such that the actuator rotates relative to the housing in response to rotation of the cap between the open and

closed positions.

21. An inhaler according to any preceding claim, wherein the housing includes a chamber to receive used blisters.

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22. An inhaler according to claim 21, wherein the used blister chamber is covered by a lid attached to the housing which is openable to facilitate removal of a portion of used blisters from the blisters remaining in the device.

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23. An inhaler according to claim 22, wherein a slot is formed between the lid and the housing when the lid is closed through which used blisters may protrude when the used blister chamber is full.

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24. An inhaler according to any preceding claim incorporating a coiled strip of blisters, each having a puncturable lid and containing a dose of medicament for inhalation by a user, located in the housing.

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25. An inhaler according to claim 24, wherein the strip includes a frangible feature between each blister to facilitate detachment of a blister from an adjacent blister along said line.

26. An inhaler according to claim 24 or claim 25, wherein the strip includes a notch to facilitate tearing of the strip between each blister.

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27. An inhaler according to any of claims 24 to 26, wherein the coiled strip carries between 30 and 60 blisters and each blister has a dose payload of between 10 and 25mg.

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28. An inhaler according to any preceding claim formed from no more than five moulded components.

29. An inhaler according to any of claims 1 to 28, formed from no more than six moulded components.

30. An inhaler according to any of claims 1 to 27, formed from no more than nine moulded components.

5 31. An inhaler according to any preceding claim wherein the housing is wholly or partially formed from a transparent or translucent material allowing the remaining blisters to be seen through the housing.

10 32. A method of using an inhaler according to any of claims 1 to 31, including the step of rotating the actuator to move a blister into alignment with the blister piercing member and to puncture the lid of an aligned blister, inhaling through the mouthpiece to generate an airflow through the blister to entrain the dose contained therein and carry it via the mouthpiece into the user's airway.

15 33. A method according to claim 32, wherein the step of rotating the actuator includes the step of rotating it in a first direction to move a blister into alignment with the blister piercing member and, rotating it in a second direction to puncture the lid of the blister aligned with the blister piercing member

20 34. A method according to claim 33, wherein the step of rotating the actuator includes the step of rotating it in a first direction to puncture the lid of a blister aligned with the blister piercing member and, once the inhalation step is complete, rotating it in a second direction to move a subsequent blister into alignment with the blister piercing member.

25 35. A method according to claim 34, wherein the step of rotating the actuator comprises the step of rotating a cap coupled to the actuator.

30 36. An inhaler comprising a housing to receive one or more blisters having a puncturable lid and containing a dose of medicament for inhalation by a user, the device comprising a blister piercing head for puncturing the lid of a blister so that the dose contained therein can be inhaled by the user from the blister through the device, wherein the piercing head comprises a primary cutting element which is

configured to cut, as the piercing member enters the blister, a first linear slit in the lid and, secondary cutting elements extending laterally from the primary cutting element which are configured to cut, as the piercing head continues to enter the blister, second linear slits that extend across each end of the first linear slit formed
5 by the primary cutting element, the primary and secondary cutting elements together forming a pair of flaps in the lid which are folded aside by the piercing head upon further entry of the piercing head into the blister.

37. An inhaler according to claim 36, wherein the piercing head comprises a pair
10 of secondary cutting elements.

38. An inhaler according to claim 37, wherein the secondary cutting elements are spaced from each other and the primary cutting element is mounted on and extends between said pair of secondary cutting elements.
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39. An inhaler according to any of claims 36 to 38, wherein the primary cutting element comprises a blade, the plane of the blade lying substantially at right angles to a plane occupied by the lid of a blister that is located in the inhaler in a position ready for piercing.
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40. An inhaler according to claim 39, wherein the primary cutting element has a sharpened edge for cutting the first linear slit in the lid of the blister.

41. An inhaler according to claim 40, wherein said edge tapers to a pointed tip.
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42. An inhaler according to claim 41, wherein a secondary piercing element extends laterally across each end of the primary piercing element.

43. An inhaler according to claim 42, wherein the pointed tip is midway between
30 the secondary cutting elements.

44. An inhaler according to any of claims 39 to 43, wherein the secondary piercing elements are each formed from a blade, the plane of the blade lying

substantially at right angles to the plane of the primary piercing element and substantially at right angles to the plane occupied by the lid of the blister.

45. An inhaler according to claim 44, wherein each of the secondary piercing
5 elements have a sharpened edge to cut the second linear slits in the lid of a blister.

46. An inhaler according to claim 45, wherein the edge of the each of the secondary piercing elements tapers to a pointed tip.

10 47. An inhaler according to claim 45, wherein the pointed tip of each of the secondary piercing elements lies in the plane of the blade forming the primary piercing element.

48. An inhaler according to claim 46 or claim 47, wherein the pointed tip of each
15 of the secondary piercing elements lie at the same height as the primary piercing element at the point at which the primary piercing element and secondary piercing element meet each other.

49. An inhaler according to any of claims 36 to 41, wherein the primary cutting
20 element divides each secondary cutting element into first and second cutting members that extend laterally from opposite sides of the primary cutting element.

50. An inhaler according to claim 49, wherein the first and second cutting
25 members converge towards each other at an angle and the primary cutting element upstands from the top of the secondary cutting members from a point on each secondary cutting element at which the first and second cutting members meet.

51. An inhaler according to claim 50, wherein the secondary cutting elements are
30 angled inwardly towards each other.

52. An inhaler according to any of claims 36 to 51, wherein the secondary
cutting elements extend laterally from the primary cutting element at an angle of 90
degrees to the primary cutting element.

53. An inhaler according to any of claims 36 to 51, wherein the secondary cutting elements extend laterally from the primary cutting element at an angle of less than 90 degrees.

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54. An inhaler according to any of claims 36 to 51, wherein the secondary cutting elements extend laterally from the primary cutting element at an angle of more than 90 degrees.

10 55. An inhaler according to any of claims 49 to 54, wherein the primary cutting element divides each of the secondary cutting elements into secondary cutting members that extend laterally from the primary cutting element by different distances so that the flap cut in the blister by the secondary cutting members extending laterally from one side of the primary cutting element is of a different size
15 to the flap cut in the blister by the secondary cutting members that extend laterally from the other side of the primary cutting member.

56. An inhaler according to any of claims 36 to 55, comprising at least two piercing heads upstanding from a piercing member.

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57. An inhaler according to any of claims 36 to 56, or to any of claims 1 to 7, wherein the piercing member comprises a discrete piercing module.

58. An inhaler according to claim 57, wherein the piercing module comprises a
25 main body portion with first and second piercing heads upstanding therefrom.

59. An inhaler according to claim 58, comprising an air inlet and an air outlet aperture extending through the main body portion, one of the piercing heads depending from the periphery of the air inlet and extending over the air inlet and
30 the other piercing head depending from the periphery of the air outlet and extending over the air outlet.

60. An inhaler according to claim 59, wherein the main body portion includes a

recessed region around the air inlet, the piercing head depending from the periphery of the air inlet from the recessed region.

61. An inhaler according to claim 59 or claim 60, wherein the air outlet aperture
5 is in communication with an air outlet tube extending from the main body in an opposite direction to the piercing head extending from the periphery of the air outlet aperture.

62. An inhaler according to claim 61, wherein the air outlet tube comprises
10 axially extending ridges formed on its outer surface which locate the piercing head within a walled recess in the mouthpiece.

63. An inhaler according to claim 62, wherein a space formed between the ridges and the walled recess comprises a bypass air conduit for the direct flow of air into
15 the mouthpiece from outside when a patient inhales through the mouthpiece.

64. An inhaler according to any of claims 14 to 17, wherein the indexing mechanism comprises a blister strip locator chassis defining a path for the strip of blisters past the aperture in the housing.
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65. An inhaler according to claim 64, wherein a resiliently deformable arm extends from the blister strip locator chassis and the indexing mechanism comprises an indexing wheel rotatably mounted to the free end of the resiliently deformable arm over which a strip of blisters is passed.
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66. An inhaler according to claim 65, wherein the indexing wheel comprises a set of spokes and the actuator includes a drive tooth engageable with a first spoke when the actuator is pivoted relative to the housing into an open position to cause the indexing wheel to rotate together with the actuator to index the blister strip.
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67. An inhaler according to claim 66, comprising an anti-rotation ramp on the housing which is engaged by another spoke of the indexing wheel when the indexing wheel rotates thereby causing the arm to deform to allow said spoke to

clear the anti-rotation ramp, the arm returning to its undeformed state once the spoke has cleared the ramp, thereby preventing rotation of the indexing wheel in the opposite direction.

5 68. An inhaler according to claim 67, wherein the drive tooth on the actuator is shaped so that, when the actuator is rotated in the opposite direction from its open into its closed position, the drive tooth slides over the top of the preceding spoke of the indexing wheel.

10 69. An inhaler according to claim 68, wherein the edge of each spoke is shaped to allow the drive tooth to pass over it when the actuator is pivoted from its open into its closed position.

15 70. An inhaler according to claim 68 or claim 69, comprising a location ramp adjacent to but spaced from the anti-rotation ramp, the drive tooth being operable to cause the arm to resiliently deform as the drive tooth slides over the top of the spoke to cause another spoke to extend into the space between the anti-rotation and location ramps and prevent rotation of the indexing wheel in either direction.